CLAIMS

What is claimed is:

1. A method of electropolishing a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the method comprising:

aligning a nozzle and the wafer to position the nozzle adjacent to the center portion of the wafer;

rotating the wafer; and

as the wafer is rotated, applying a stream of electrolyte from the nozzle onto a portion of the metal layer adjacent to the center portion of the wafer to begin to electropolish the portion of the metal layer with a triangular polishing profile to initially expose an underlying layer underneath the metal layer at a point.

2. The method of claim 1, wherein the metal layer includes copper, and wherein the underlying layer is a barrier layer.

3. The method of claim 1, further comprising:

after the underlying layer has been initially exposed at a point, applying the stream of electrolyte from the nozzle onto additional portions of the metal layer extending from the center portion toward the edge portion of the wafer; and

adjusting the triangular polishing profile to have a flatter apex when the stream of electrolyte is applied to the additional portions of the metal layer.

4. The method of claim 3, wherein adjusting the triangular polishing profile comprises:

applying a first polishing current to the stream of electrolyte when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer; and

applying a second polishing current, which is higher than the first polishing current, when the stream of electrolyte is applied to the additional portions of the metal layer.

5. The method of claim 3, wherein adjusting the triangular polishing profile comprises:

applying the stream of electrolyte using a first nozzle when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer; and

applying the stream of electrolyte using a second nozzle, which is larger than the first nozzle, when the stream of electrolyte is applied to the additional portions of the metal layer.

6. The method of claim 1, wherein the wafer and the nozzle are not moved in a lateral direction when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer until the underlying layer is initially exposed at a point.

7. The method of claim 6, wherein, when the underlying layer is initially exposed at a point, the wafer or nozzle is moved in a lateral direction to apply the stream of electrolyte to additional portions of the metal layer extending from the center portion toward the edge portion of the wafer.

8. The method of claim 1, wherein aligning a nozzle adjacent to the center portion of the wafer comprises:

moving the wafer to align the center portion of the wafer adjacent to the nozzle.

9. The method of claim 1, wherein aligning a nozzle adjacent to the center portion of the wafer comprises:

moving the nozzle to align the center portion of the wafer adjacent to the center portion of the wafer.

10. The method of claim 1, wherein aligning a nozzle adjacent to the center portion of the wafer comprises:

moving the nozzle and the wafer relative to one another to align the nozzle adjacent to the center portion of the wafer.

11. A system to electropolish a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the system comprising:

a wafer chuck to rotate the wafer; and

a nozzle,

wherein the nozzle and the wafer are aligned to position the nozzle adjacent to the center portion of the wafer, and

wherein, as the wafer is rotated, a stream of electrolyte is applied from the nozzle onto a portion of the metal layer adjacent to the center portion of the wafer to begin to electropolish the portion of the metal layer with a triangular polishing profile to initially expose an underlying layer underneath the metal layer at a point.

12. The system of claim 11, wherein the metal layer includes copper, and wherein the underlying layer is a barrier layer.

13. The system of claim 11,

wherein, after the underlying layer has been initially exposed at a point, the stream of electrolyte is applied from the nozzle onto additional portions of the metal layer extending from the center portion toward the edge portion of the wafer, and

wherein the triangular polishing profile is adjusted to have a flatter apex when the stream of electrolyte is applied to the additional portions of the metal layer.

14. The system of claim 13, further comprising a power supply configured to:

apply a first polishing current to the stream of electrolyte when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer; and

apply a second polishing current, which is higher than the first polishing current, when the stream of electrolyte is applied to the additional portions of the metal layer.

15. The system of claim 13, wherein the nozzle comprises:

a first nozzle configured to apply the stream of electrolyte when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer; and

a second nozzle configured to apply the stream of electrolyte when the stream of electrolyte is applied to the additional portions of the metal layer, wherein the second nozzle is bigger than the first nozzle.

16. The system of claim 11, wherein the wafer and nozzle are not moved in a lateral direction when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer until the underlying layer is initially exposed at a point.

17. The system of claim 16, wherein, when the underlying layer is initially exposed at a point, the wafer or nozzle is moved in a lateral direction to apply the stream of electrolyte to additional portions of the metal layer extending from the center portion toward the edge portion of the wafer.

18. The system of claim 11, further comprising a guide rod configured to move the wafer to align the center portion of the wafer adjacent to the nozzle.

19. The system of claim 11, further comprising a guide rod configured to move the nozzle to align the center portion of the wafer adjacent to the center portion of the wafer.

20. The system of claim 11, further comprising:

a first guide rod configured to move the nozzle; and

a second guide rod configured to move the wafer.

21. A method of electropolishing a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the method comprising:

aligning a nozzle and the wafer to position the nozzle adjacent to the center portion of the wafer at an off-set distance from the center portion of the wafer;

rotating the wafer; and

as the wafer is rotated, applying a stream of electrolyte from the nozzle onto a portion of the metal layer adjacent to the center portion of the wafer at the off-set distance from the center portion of the wafer to begin to electropolish the portion of the metal layer, wherein the stream of electrolyte is applied on a contact area on the portion of the metal layer, and wherein the off-set distance is equal to or less than the radius of the contact area.

22. The method of claim 21,

wherein the wafer or nozzle is moved in a lateral direction when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer at the off-set distance to expose an underlying layer,

wherein, when the underlying layer is exposed, the wafer or nozzle is moved in a lateral direction to apply the stream of electrolyte to additional portions of the metal layer from the center portion toward the edge portion of the wafer, and

wherein the wafer or nozzle is moved slower while the underlying layer is being exposed than once the underlying layer has been exposed.

23. The method of claim 21, wherein aligning a nozzle adjacent to the center portion of the wafer comprises:

moving the wafer to align the center portion of the wafer adjacent to the nozzle.

24. The method of claim 21, wherein aligning a nozzle adjacent to the center portion of the wafer comprises:

moving the nozzle to align the center portion of the wafer adjacent to the center portion of the wafer.

25. The method of claim 21, wherein aligning a nozzle adjacent to the center portion of the wafer comprises:

moving the nozzle and the wafer relative to one another to align the nozzle adjacent to the center portion of the wafer.

26. A system to electropolish a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the system comprising:

a wafer chuck configured to rotate the wafer; and

a nozzle,

wherein the nozzle and the wafer are aligned to position the nozzle adjacent to the center portion of the wafer at an off-set distance from the center portion of the wafer,

wherein, as the wafer is rotated, a stream of electrolyte is applied from the nozzle onto a portion of the metal layer adjacent to the center portion of the wafer at the off-set distance from the center portion of the wafer to begin to electropolish the portion of the metal layer,

wherein the stream of electrolyte is applied on a contact area on the portion of the metal layer, and

wherein the off-set distance is equal to or less than the radius of the contact area.

27. The system of claim 26,

wherein the wafer or nozzle is moved in a lateral direction when the stream of electrolyte is applied to the portion of the metal layer adjacent to the center portion of the wafer at the off-set distance to expose an underlying layer,

wherein, when the underlying layer is exposed, the wafer or nozzle is moved in a lateral direction to apply the stream of electrolyte to additional portions of the metal layer from the center portion toward the edge portion of the wafer, and

wherein the wafer or nozzle is moved slower while the underlying layer is being exposed than once the underlying layer has been exposed.

28. The system of claim 26, further comprising a guide rod configured to move the wafer to align the center portion of the wafer adjacent to the nozzle.

29. The system of claim 26, further comprising a guide rod configured to move the nozzle to align the center portion of the wafer adjacent to the center portion of the wafer.

30. The system of claim 26, further comprising:

a first guide rod configured to move the nozzle; and

a second guide rod configured to move the wafer.

31. A method of electropolishing a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the method comprising:

before electropolishing the metal layer, obtaining a thickness profile of the metal layer;

rotating the wafer;

as the wafer is rotated, applying a stream of electrolyte from a nozzle onto portions of the metal layer extending from the center portion toward the edge portion of the wafer; and

varying a lateral relative speed between the wafer and the nozzle as the stream of electrolyte is applied onto portion of the metal layer extending from the center portion toward the edge portion of the wafer based on the obtained thickness profile of the metal layer.

32. The method of claim 31, further comprising:

calculating a first set of averaged thicknesses of the metal layer at points at the same radial location but different theta locations on the wafer; and

calculating a second set of averaged thicknesses of the metal layer based on two or more of the averaged thickness from the first set of averaged thicknesses.

33. The method of claim 32, further comprising:

determining a lateral relative speed compensation factor at a radial location on the wafer, wherein the lateral relative speed at the radial location is determined based on an averaged thickness at the radial location on the wafer from the second set of averaged thicknesses.

34. The method of claim 33, wherein the lateral relative speed compensation factor at a radial location is determined based on an acceleration factor and a ratio of a thickness of the metal layer at the radial location resulting from electropolishing the metal layer without varying the lateral relative speed and the averaged thickness at the radial location on the wafer from the second set of averaged thicknesses.

35. The method of claim 32, further comprising:

determining a lateral relative speed compensation curve based on the lateral relative speed compensation factor at different radial locations on the wafer.

36. The method of claim 31, wherein applying a stream of electrolyte comprises moving the wafer between a first position in which the nozzle is adjacent to the center portion of the wafer and a second position in which the nozzle is adjacent to the edge portion of the wafer, and wherein varying a lateral relative speed comprises adjusting a lateral relative speed of the wafer as the wafer is moved between the first position and the second position.

37. The method of claim 31, wherein applying a stream of electrolyte comprises moving the nozzle between a first position adjacent to the center portion of the wafer and a second position adjacent to the edge portion of the wafer, and wherein varying a lateral relative speed comprises adjusting a lateral relative speed of the nozzle as the nozzle is moved between the first position and the second position.

38. The method of claim 31, wherein applying a stream of electrolyte comprises moving the nozzle and the wafer relative to one another between a first position in which the nozzle is adjacent to the center portion of the wafer and a second position in which the nozzle is adjacent to the edge portion of the wafer, and wherein varying a lateral relative speed comprises adjusting a lateral relative speed of the nozzle and the nozzle as the nozzle and the wafer are moved between the first position and the second position.

39. A system to electropolish a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the system comprising:

a wafer chuck configured to rotate the wafer;

a nozzle, wherein, as the wafer is rotated, a stream of electrolyte is applied from a nozzle onto portions of the metal layer extending from the center portion toward the edge portion of the wafer; and

a processor configured to:

obtain a thickness profile of the metal layer before electropolishing the metal layer, and

vary a lateral relative speed between the wafer and the nozzle as the stream of electrolyte is applied onto portion of the metal layer extending from the center portion toward the edge portion of the wafer based on the obtained thickness profile of the metal layer.

40. The system of claim 39, wherein the processor is further configured to:

calculate a first set of averaged thicknesses of the metal layer at points at the same radial location but different theta locations on the wafer; and

calculate a second set of averaged thicknesses of the metal layer based on two or more of the averaged thickness from the first set of averaged thicknesses.

41. The system of claim 40, wherein the processor is further configured to:

determine a lateral relative speed compensation factor at a radial location on the wafer, wherein the lateral relative speed at the radial location is determined based on an averaged thickness at the radial location on the wafer from the second set of averaged thicknesses.

42. The system of claim 41, wherein the lateral relative speed compensation factor at a radial location is determined based on an acceleration factor and a ratio of a thickness of the metal layer at the radial location resulting from electropolishing the metal layer without varying the lateral relative speed and the averaged thickness at the radial location on the wafer from the second set of averaged thicknesses.

43. The system of claim 40, wherein the processor is further configured to:

determine a lateral relative speed compensation curve based on the lateral relative speed compensation factor at different radial locations on the wafer.

44. The system of claim 39, further comprising a guide rod configured to move the wafer between a first position in which the nozzle is adjacent to the center portion of the wafer and a second position in which the nozzle is adjacent to the edge portion of the wafer, and wherein the processor is configured to adjust a lateral relative speed of the wafer as the wafer is moved between the first position and the second position.

45. The system of claim 39, further comprising a guide rod configured to move the nozzle between a first position adjacent to the center portion of the wafer and a second position adjacent to the edge portion of the wafer, and wherein the processor is configured to vary a lateral relative speed comprises adjusting a lateral relative speed of the nozzle as the nozzle is moved between the first position and the second position.

46. The system of claim 39, further comprising a first guide rod configured to move the nozzle and a second guide rod configured to move the wafer, wherein the first and second guide rods move the nozzle and the wafer relative to one another between a first position in which the nozzle is adjacent to the center portion of the wafer and a second position in which the nozzle is adjacent to the edge portion of the wafer, and wherein the processor is configured to vary a lateral relative speed comprises adjusting a lateral relative speed of the nozzle and the nozzle as the nozzle and the wafer are moved between the first position and the second position.

47. A method of electropolishing a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the method comprising:

rotating the wafer;

as the wafer is rotated, applying a stream of electrolyte from a nozzle onto the metal layer between the center portion to the edge portion of the wafer; and

maintaining a constant viscosity of the electrolyte in the stream of electrolyte as the stream of electrolyte is applied onto the metal layer between the center portion and the edge portion of the wafer.

48. The method of claim 47, wherein maintaining a constant viscosity of the electrolyte comprises:

measuring a water content in the electrolyte; and

controlling a water-to-electrolyte balance in the electrolyte based on the measured water content in the electrolyte.

49. The method of claim 48, wherein the water content in the electrolyte is measured using a temperature compensated viscosity meter.

50. The method of claim 48, wherein controlling a wafer-to-electrolyte balance comprises:

setting a temperature set point based on the measured water content of the electrolyte;

controlling the temperature of an electrolyte reservoir, which supplies the electrolyte to the nozzle, to the temperature set point where the water evaporation rate is higher than the wafer absorption rate; and

dosing water into the electrolyte reservoir to control the water-to-electrolyte balance.

51. The method of claim 48, wherein maintaining a constant viscosity of the electrolyte comprises:

measuring physical viscosity of the electrolyte;

setting a temperature set point based on the measured physical viscosity; and

controlling the temperature of an electrolyte reservoir, which supplies the electrolyte to the nozzle, based on the temperature set point; and

dosing water into the electrolyte reservoir to control a water-to-electrolyte balance in the electrolyte based on the temperature set point.

52. A system to electropolish a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the system comprising:

a wafer chuck configured to rotate the wafer;

a nozzle configured to apply a stream of electrolyte onto the metal layer between the center portion to the edge portion of the wafer as the wafer is rotated; and

a processor configured to maintain a constant viscosity of the electrolyte in the stream of electrolyte as the stream of electrolyte is applied onto the metal layer between the center portion and the edge portion of the wafer.

53. The system of claim 52, further comprising:

an electrolyte reservoir connected to the nozzle to provide electrolyte to the nozzle;

a temperature control unit connected to the electrolyte reservoir, wherein the temperature control unit controls the temperature of the electrolyte in the electrolyte reservoir,

a water dosing inlet connected to the electrolyte reservoir to add water to the electrolyte reservoir; and

a water dosing valve connected to the water dosing inlet to open and close the water dosing inlet,

wherein the processor sends a temperature set point to the temperature control unit, and

wherein, at the temperature set point, the water evaporation rate is higher than the wafer absorption rate in the electrolyte reservoir.

54. The system of claim 53, further comprising:

a temperature compensated viscosity meter configured to measure a water content in the electrolyte,

wherein the processor operates the water dosing valve to control a water-to-electrolyte balance in the electrolyte based on the water content measured by the temperature compensated viscosity meter.

55. The system of claim 53, further comprising:

a viscosity meter to measure the physical viscosity of the electrolyte,

wherein the processor operates the water dosing valve to control a water-to-electrolyte balance in the electrolyte based on the physical viscosity measured by the viscosity meter.

56. A method of electropolishing a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the method comprising:

rotating the wafer;

as the wafer is rotated, applying a stream of electrolyte from a nozzle onto the metal layer between the center portion to the edge portion of the wafer; and

maintaining a constant flow rate of the electrolyte in the stream of electrolyte as the stream of electrolyte is applied onto the metal layer between the center portion and the edge of the wafer.

57. The method of claim 56, wherein maintaining a constant flow rate comprises:

measuring a flow rate of the electrolyte as the electrolyte is supplied from an electrolyte reservoir to the nozzle;

controlling the flow rate using a control valve, a look-up table, and the measured flow rate to maintain the flow rate at the constant flow rate.

58. The method of claim 57, wherein controlling the flow rate comprises:

controlling a pneumatic pressure regulator connected to the control valve to adjust the pressure of pilot air applied to the control valve to maintain the flow rate at the constant flow rate.

59. The method of claim 58, wherein the look-up table is generated by:

a) directing the pneumatic pressure regulator to generate an amount of pressure, which is a portion of a full pressure, of the pilot air to the control valve;

b) after a), recording the flow rate of the electrolyte;

e) repeating a) and b) for any number of different amounts of pressures to generate entries in the look-up table of different amounts of pressure and the flow rate of the electrolyte resulting from the different amounts of pressure applied to the control valve.

60. The method of claim 59, further comprising:

periodically regenerating or updating the look-up table.

61. The method of claim 59, further comprising:

searching in the look-up table for a matching flow rate for a desired flow rate (f0); and

when the matching flow rate is not found in the look-up table, determining an initial amount of pressure (P1) using at least two entries in the look-up table.

62. The method of claim 61, wherein determining an initial amount of pressure (P1) comprises:

locating an entry in the look-up table for a first flow rate greater than the desired flow rate (f(n)) and an entry for a second flow rate less than the desired flow rate (f(n-1)), wherein the first flow rate corresponds to a first amount of pressure (P(n)) and the second flow rate corresponds to a second amount of pressure (P(n-1)), and wherein P1 is determined by interpolation.

63. The method of claim 62, wherein $P1 = P(n-1)+(f0-f(n-1))*(P(n)-P(n-1)/f(n)-f(n-1))$.

64. The method of claim 62, further comprising:

after determining P1, directing the pneumatic pressure regulator to generate an amount of pressure equal to P1;

measuring a flow rate (f(1)); and

when f(1) differs from f0 by an amount greater than a margin of error, determining an adjusted amount of pressure (P2).

65. The method of claim 64, wherein $P2 = P1+(f0-f1)*(P(n)-P(n-1)/(f(n)-(f(n-1))$.

66. A system to electropolish a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the system comprising:

a wafer chuck configured to rotate the wafer;

a nozzle configured to apply a stream of electrolyte onto the metal layer between the center portion to the edge portion of the wafer as the wafer is rotated; and

an electrolyte supply system configured to maintain a constant flow rate of the electrolyte in the stream of electrolyte as the stream of electrolyte is applied onto the metal layer between the center portion and the edge of the wafer.

67. The system of claim 66, wherein the electrolyte supply system comprises:

an electrolyte reservoir connected to the nozzle to supply electrolyte to the nozzle;

a flow rate meter disposed between the electrolyte reservoir and the nozzle to measure the flow rate of the electrolyte as the electrolyte is supplied from the electrolyte reservoir to the nozzle;

a control valve disposed between the electrolyte reservoir and the nozzle to control the flow of electrolyte to the nozzle from the electrolyte reservoir, and

a processor configured to control the flow of electrolyte using the control valve based on the flow rate measured by the flow rate meter and a look-up table with a relationship between pressure and flow rate.

68. The system of claim 67, further comprising:

a pneumatic pressure regulator connected to the control valve,

wherein the processor uses the pneumatic pressure regulator to adjust the pressure of pilot air applied to the control valve to maintain the flow rate at the constant flow rate.

69. The system of claim 68, wherein the processor is configured to generate the look-up table by:

a) directing the pneumatic pressure regulator to generate an amount of pressure, which is a portion of a full pressure, of the pilot air to the control valve;

b) after a), recording the flow rate of the electrolyte;

e) repeating a) and b) for any number of different amounts of pressures to generate entries in the look-up table of different amounts of pressure and the flow rate of the electrolyte resulting from the different amounts of pressure applied to the control valve.

70. The system of claim 69, wherein the processor is configured to periodically regenerate or update the look-up table.

71. The system of claim 69, wherein the processor is further configured to:

search in the look-up table for a matching flow rate for a desired flow rate (f0); and

when the matching flow rate is not found in the look-up table, determine an initial amount of pressure (P1) using at least two entries in the look-up table.

72. The system of claim 71, wherein the processor is configured to determine an initial amount of pressure (P1) by:

locating an entry in the look-up table for a first flow rate greater than the desired flow rate (f(n)) and an entry for a second flow rate less than the desired flow rate (f(n-1)), wherein the first flow rate corresponds to a first amount of pressure (P(n)) and the second flow rate corresponds to a second amount of pressure (P(n-1)), and wherein P1 is determined by interpolation.

73. The system of claim 72, wherein P1 = P(n-1)+(f0-f(n-1))*(P(n)-P(n-1)/f(n)-f(n-1)).

74. The system of claim 72, wherein the processor is further configured to:

after P1 is determined, direct the pneumatic pressure regulator to generate an amount of pressure equal to P1;

obtain a flow rate (f(1)) measurement; and

when f(1) differs from f0 by an amount greater than a margin of error, determine an adjusted amount of pressure (P2).

75. The system of claim 74, wherein P2 = P1+(f0-f1)*(P(n)-P(n-1)/(f(n)-(f(n-1)).

76. A method of electropolishing a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the method comprising:

rotating the wafer;

as the wafer is rotated, applying a stream of electrolyte from a nozzle onto the metal layer between the center portion to the edge portion of the wafer;

measuring the temperature of the electrolyte in the stream of electrolyte; and

adjusting a polishing current applied to the stream of electrolyte based on the temperature of the electrolyte.

77. The method of claim 76, wherein adjusting an electrical current comprises:

reducing the electrical current when the temperature of the electrolyte increases.

78. A system to electropolish a metal layer formed on a wafer, the wafer having a center portion and an edge portion, the system comprising:

a wafer chuck configured to rotate the wafer;

a nozzle configured to apply a stream of electrolyte from a nozzle onto the metal layer between the center portion to the edge portion of the wafer as the wafer is rotated;

a temperature sensor configured to measure the temperature of the electrolyte in the stream of electrolyte;

a power supply configured to apply a polishing current to the stream of electrolyte; and

a processor configured to adjust the polishing current applied to the stream of electrolyte based on the temperature of the electrolyte measured by the temperature sensor.

79. The system of claim 78, wherein the processor is configured to reduce the electrical current when the temperature of the electrolyte increases.

80. A method of electropolishing a metal layer formed on a wafer, the method comprising:

applying a stream of electrolyte from a nozzle onto the metal layer to electropolish the metal layer;

pumping electrolyte from an electrolyte reservoir to the nozzle;

after the stream of electrolyte is applied from the nozzle onto the metal layer, returning the electrolyte back to the electrolyte reservoir; and

removing bubbles from the electrolyte in the electrolyte reservoir before pumping the electrolyte back to the nozzle from the electrolyte reservoir.

81. The method of claim 80,

wherein the electrolyte is pumped from the electrolyte reservoir through an outlet located adjacent to a bottom portion of the electrolyte reservoir,

wherein the electrolyte is returned to the electrolyte reservoir through an inlet in the electrolyte reservoir, and

wherein the electrolyte flows through channels formed in the electrolyte reservoir between the inlet and outlet to remove bubbles from the electrolyte.

82. The method of claim 81,

wherein the electrolyte flows from the inlet through a first channel in a first direction,

wherein the electrolyte flows from the first channel into a second channel in a second direction, which is in the opposite direction from the first direction,

wherein the electrolyte flows from the second channel into a third channel in a third direction, which is the opposite direction from the second direction and in the same direction as the first direction, and

wherein the electrolyte flows from the third channel into the outlet.

83. The method of claim 81, wherein the channels are defined by at least two dividers placed within the electrolyte reservoir.

84. A system to electropolish a metal layer formed on a wafer, the system comprising:

a nozzle configured to apply a stream of electrolyte from a nozzle onto the metal layer to electropolish the metal layer;

an electrolyte reservoir configured to supply electrolyte to the nozzle; and

a pump to pump the electrolyte from the electrolyte reservoir to the nozzle,

wherein, after the stream of electrolyte is applied from the nozzle onto the metal layer, the electrolyte returns to the electrolyte reservoir, and

wherein the electrolyte reservoir is configured to remove bubbles from the electrolyte in the electrolyte reservoir before the electrolyte is pumped back to the nozzle from the electrolyte reservoir.

85. The system of claim 84, further comprising:

an outlet located adjacent to a bottom portion of the electrolyte reservoir, wherein the electrolyte is pumped from the electrolyte reservoir through the outlet;

an inlet located in the electrolyte reservoir, wherein the electrolyte is returned to the electrolyte reservoir through the inlet; and

channels formed in the electrolyte reservoir between the inlet and outlet to remove bubbles from the electrolyte when the electrolyte flows through the channels.

86. The system of claim 85, wherein the channels comprises

a first channel, wherein the electrolyte flows from the inlet through the first channel in a first direction;

a second channel, wherein the electrolyte flows from the first channel into the second channel in a second direction, which is in the opposite direction from the first direction; and

a third channel, wherein the electrolyte flows from the second channel into the third channel in a third direction, which is the opposite direction from the second direction and in the same direction as the first direction, and wherein the electrolyte flows into the outlet from the third channel.

87. The system of claim 85, further comprising:

at least two dividers placed within the electrolyte reservoir to define the channels.